Teacher's Background

Leaves and mushrooms on forest floor

Earth's **biodiversity** is amazing. The fact that scientists have identified more than 1.5 million species and estimate that there are millions more provides evidence of that biodiversity. Isolated, these species could not survive, but together with Earth's non-living components, such as carbon, nitrogen, oxygen, minerals in soil, and water, they make up the **natural system**.

In natural systems, living and non-living components participate in and influence such processes and cycles as energy transfer and conversion, the water and nitrogen cycle, and reproduction. Removing or changing any one component in a natural system can influence the cycles or processes that are necessary for its functioning. Exploring the components within natural systems and the connections among their functions enables students to understand that, as human beings, they are not isolated from natural systems. Humans are a part of these systems and depend on the systems' processes and cycles for food to eat, water to drink, and air to breathe.

One important process in every natural system is **decomposition**. Decomposition is the breaking down of matter into its smallest components, chemical elements. A decomposer is an organism that participates in that process somehow, breaking down organic matter that once was living. Some organisms simply consume "dead" matter and transform it from solid to liquid in their waste, while other organisms use enzymes to digest organic matter, such as leaf litter and animal waste, chemically, thereby releasing the essential nutrients trapped inside.

The two categories of living things that participate in decomposition do so in distinct ways. The first type of organism is a scavenger. Scavengers participate in the decomposition process, but they are not "true" decomposers, as they do not break down material into its

simplest chemical elements. Through their feeding process and physical digestion, scavengers break down material into smaller pieces for "true" decomposers to work on. Worms, pill bugs, springtails, maggots, and turkey vultures are examples of scavengers.

The true decomposers in the natural system are **fungi** and **bacteria**. Bacteria are microorganisms invisible to the naked eye. In fact, many bacteria are so small that 1,000 could fit on a pinhead. Most are single-celled organisms that need to eat as other consumers do; however, they lack the classic parts of the digestive system that other living things have—a mouth, stomach, or intestines. Bacteria absorb nutrients through pores in their cell walls. In order to do this, they, like fungi, must come into direct contact with their "food." Fungi attach themselves to and grow on the surface of living and non-living things. To obtain the nutrients they need, they first secrete enzymes onto the organic material they are "eating." These enzymes begin to break down the organic matter. The fungi then absorb the nutrients from the matter through their *mycelium* or filamentous (hair-like) parts.

The "partnership" between scavengers and true decomposers makes the process of decomposition extremely efficient. True decomposers can only absorb the smallest components of organic matter, and they have a much easier time doing so when the matter is in small pieces. This works on several levels. When an animal or plant dies or part of a plant breaks off from the main part of the plant (a leaf or limb off a tree, for example), scavengers bite, grind, chew, and tear the material into pieces, exposing much more surface area of the "dead" matter on which the true decomposers can work. Additionally, true decomposers feed on the solid wastes excreted by scavengers after they have eaten the "dead" matter. That waste contains many of the nutrients locked up in the original "dead" matter, but the decomposers present in the digestive systems of scavengers (and all consumers) have broken down those nutrients. There are even some scavengers that prefer their "meal" be partially broken down and softened by bacteria and fungi before they eat it. While the decomposition process might be possible without scavengers, it would be absolutely impossible without the true decomposers. But the partnership these organisms have forged increases the speed at which the process moves, which increases the benefits to natural and human social systems.

The "decomposition team" of true decomposers and scavengers serves ecosystems in three important ways. First, decomposers are present on all levels of the food web. Because decomposers live everywhere, including inside and on many other organisms, consumers and scavengers eat them, either directly as a preferred food source or indirectly when one consumer eats another consumer or a producer. For example, as an earthworm tunnels and burrows through soil, it swallows plant scraps as well as decomposing microorganisms living in the soil. Later a bird, lizard, or mole might eat that same earthworm. In this way, decomposers form a vital link in all food chains.

Second, decomposers act as a "cleanup crew"" for the natural system by breaking down dead matter and wastes, converting them to useful nutrients and chemical elements and making them accessible to other

Turkey vulture

Estuary near Ventura, California

living things. Imagine if, year after year, all the fallen leaves, animal carcasses, and solid wastes remained intact on Earth's surface. As organisms on our planet have been living and dying, eating and excreting wastes for over 3.5 billion years, by now dead debris would cover Earth, leaving no space for the living. By breaking down dead matter and wastes, the decomposition team of scavengers and decomposers helps the natural system and human communities manage "waste."

Third, the actions of the decomposition team form a critical stage in the **nutrient cycle**. Nutrients are the chemical building blocks that give all living things the matter and energy to grow and reproduce. For most animals, proteins, carbohydrates, and water comprise these nutrients. The work of decomposers makes these nutrients available in the soil, in the air, and in the water and helps organisms unlock the power of these nutrients.

All organic matter contains nutrients in tissue. As decomposers feed on organic matter, they convert tissue into smaller, simpler chemicals, releasing chemicals like carbon, nitrogen, and water into the surrounding environment. Without decomposers, these nutrients would remain locked up in tissue and in animal wastes. Once water and nitrogen are in the air and soil, plants absorb them and use them in photosynthesis. The plants either become a source of food or produce food for consumers, including scavengers. The process of breaking down matter and making the chemicals contained therein available allows the nutrient cycle to continue.

All Earth's ecosystems have a similar reliance on the nutrient cycle and, therefore, on decomposition. Terrestrial, aquatic, and marine ecosystems all depend on decomposers as key components serving the same roles. An absence of decomposers in any ecosystem has serious implications for all other living things in the ecosystem. Even human agricultural practices and waste management systems ultimately depend on the work of decomposers.

In California, coastal estuaries have supported the growth and development of human communities and economies. An estuary is an area where the fresh water from rivers meets and mixes with salt water from the ocean, often located in bays or other inlets. Coastal estuaries exist throughout California. Examples include the San Francisco Estuary, Morro Bay, and Upper Newport Bay.

Due to a high inflow of plant matter from rivers, decomposers thrive in coastal estuaries. The decomposers break down the plant matter and release nutrients back into the aquatic ecosystem. The nutrient-rich soils and waters that result from the work of decomposers provide nutrients to all the producers in the estuary ecosystem: phytoplankton and algae, cordgrass, eel grass, and other estuarine plants. These plants supply food and shelter for a variety of fish, from herring to halibut, and marine invertebrates, such as Dungeness crab. The fish provide food for other animals, including humans. In fact, approximately 75 percent of all commercially harvested fish lived in an estuary at some point in their life cycle. Hence, the commercial fishing industry relies on healthy coastal estuaries, which in turn rely on decomposers to maintain their amazing productivity.

Importantly, coastal estuaries can also remove pollutants from water and soil. Decomposers and the plants they support within estuaries filter out high loads of nutrients and toxic byproducts of wastewater and runoff carried in from upland cities and agricultural fields. Bacteria in estuaries can tolerate substances that would kill other organisms. In the case of some of these dangerous toxins, decomposers, through their metabolic processes, can remove many organic compounds found in municipal wastewater and stormwater runoff. With the more harmful compounds broken down, estuary plants are then

able to absorb the remaining contaminants as water flushes through the estuary on its way to the ocean.

California's agricultural economy would not be possible without decomposers. Rich topsoil is an ecosystem good that is a very important component of the rich soils that California's farmers have relied upon for 200 years. Not all topsoil is the same. Topsoil's organic content, called humus, affects the quality of the topsoil. Humus is organic material in the very last stage of decomposition. Decomposers get the organic material to this stage. When properly mixed with inorganic sediments, humus:

- provides the essential nutrients required by growing plants
- creates space in the soil for gases and water sought by plant roots
- controls pH levels to keep soil from becoming too acidic or too alkaline
- absorbs heat, which creates better germinating conditions for seeds

Without decomposers, there would be no humus, making human agriculture next to impossible.

The amount of topsoil on the planet suitable for growing food is limited. Topsoil can be lost through erosion or depleted of nutrients through overuse. The United States loses 1.7 billion tons of topsoil to erosion every year. As farmlands become less **fertile** due to over-farming, more gardeners and commercial farmers are turning to composting. Composting is simply a controlled process that encourages decomposition in a contained environment. The benefits of composting are threefold. Composting capitalizes on decomposers' ability to build fertile soil, it takes advantage of decomposers' ability to break down matter, and it keeps organic waste out of the landfills. In fact, many municipalities in California have turned to composting as a means of managing their solid waste while also producing soil enhancers.

For the many reasons discussed here, decomposers are essential, not only to natural systems, but also to human practices such as food production and waste management.

Farm crops

Glossary

Bacteria: Microscopic, one-celled organisms that play a key role in decomposition.

Biodiversity (biological diversity): The variety of life over some spatial unit, used to describe all aspects of the broadly diverse forms into which organisms have evolved, especially species richness, ecosystem, complexity, and genetic variation.

Decomposer: An organism, such as a bacterium or fungus, that breaks down organic matter into its chemical and mineral components.

Decomposition: The breaking down of organic matter into its chemical and mineral components.

Fertile (land): Pertaining to soil that produces abundant plant growth because it is rich in nutrients.

Fungus: An organism such as a mushroom that lacks chlorophyll and obtains energy and matter primarily from dead organic matter.

Human Social Systems: The basic constructs, functions, and interactions within and between human communities and societies.

Humus: The dark brown or black layer in soil that consists of decayed organic matter. Humus increases soil fertility and water retention.

Natural System: The interacting and/or interdependent components, processes, cycles, and interactions among organisms and their habitats.

Nutrient Cycle: The cycling of a chemical element, such as nitrogen, through the environment.

Organic: Containing carbon compounds, as in relating to or derived from living organisms.

Scavenger: An animal such as a vulture or earthworm that obtains energy and matter by eating dead organisms.

Topsoil: The upper layer of soil, characterized by a higher content of organic matter.

Unit Planner

	Lesson	Learning Objective(s)	At a Glance
1	**Breaking It Down** **Preparation Time:** 45 min. **Instructional Time:** 50 min.	■ Give examples of organisms that are decomposers. ■ Provide examples of human practices that directly depend on the cycles and processes involving decomposers in terrestrial, freshwater, coastal, and marine ecosystems (e.g., their role in food production and waste management).	Students read a story about three approaches to composting, identify the decomposers in the described compost bins, and diagram the food chains represented. They set up a composting lab using bananas and yeast, and make predictions about the decomposition process.
2	**Decomposers and Scavengers** **Preparation Time:** 20 min. **Instructional Time:** 50 min.	■ Give examples of organisms that are decomposers. ■ Explain the role of decomposers in an ecosystem.	Students match descriptions of decomposers and scavengers to the pictures and names of actual organisms. They compare characteristics of decomposers to those of scavengers. Using clues, students identify examples of decomposers and scavengers on photo cards.
3	**A Big Job for a Tiny Crew** **Preparation Time:** 30 min. **Instructional Time:** 50 min.	■ Explain the role of decomposers in an ecosystem. ■ Recognize that the cycles and processes involving recycling of matter and transfer of energy among organisms are essential to the functioning of natural systems (ecosystems).	Students observe evidence of decomposition and apply this concept in a discussion about the role of decomposers in ecosystems. They listen to two narratives describing decomposition and create diagrams showing decomposers and scavengers in the food web.
4	**Waste Not** **Preparation Time:** 15 min. **Instructional Time:** 50 min.	■ Provide examples of human practices that directly depend on the cycles and processes involving decomposers in terrestrial, freshwater, coastal, and marine ecosystems (e.g., their role in food production and waste management). ■ Describe the dependence of human practices on the cycles and processes that occur in terrestrial, freshwater, coastal, and marine ecosystems (e.g., the role of decomposers in: food production through soil formation and fertility; waste management through the decay of waste products).	Students interpret a diagram showing a wastewater management system. They discuss the presence of particular organisms that help decompose matter in the system. Students answer questions about the waste management system and humans' dependence on decomposers to make the system work.

Prerequisite Knowledge

Students should know about:
- What plants need to survive.
- The basic components of soil.
- Food chains and food webs.

Students should be able to:
- Identify producers and consumers within food chains.
- Generate a reasonable prediction based on prior knowledge or experience.
- Use a gram scale to determine the weight of an object.

Students should have:
- Completed previous lesson.

Students should be able to:
- Identify characters and events in a story and use a graphic organizer to illustrate the connection between them.

Students should have:
- Completed previous lessons.

All Materials Needed

Lesson Toolboxes identify lesson-specific needs.

Activity Supplies:
- Bananas: four per class, ripe
- Dry active yeast: four packets per class
- Knife: one per class
- Paper towels: one roll
- Self-sealing plastic bags: two per group of four students, plus one extra for the teacher
- Teaspoons: one per group of four students
- Trays (optional): one per group of four students
- Butcher paper: one six-foot sheet per class (light color)
- Apple: One per class
- Buckets: Two per class, 1 gallon or bigger
- Cups: One per student, at least 16 ounces
- Index cards: Two
- Magnifying glass: One per student
- Measuring cups: Two half-cup measuring cups
- Potting soil: Ten cups of potting soil with high organic content
- Sand: Ten cups of hygienic sandbox sand

A-V equipment:
- Overhead or LCD projector, screen

Class supplies:
- Chart paper (optional), colored pencils, markers, masking tape, pencils, stapler, staples, transparency markers

Textbook Alignment

Houghton Mifflin: Unit B Ch.4: 114-127, 1134-137, 143, 146

Macmillan/ McGraw-Hill: Pages 36, 38, 62, 64-69

Harcourt: Pages 166-177

TPS: TE pages 133-146

FOSS: Environments: Investigation 3 Part 3-4 pages 136-150, Investigation 4 Part 3 pages 181-186

Unit Planner

	Lesson	Learning Objective(s)	At a Glance
5	**Down on the Farm** **Preparation Time:** 30 min. **Instructional Time:** 50 min.	■ Provide examples of human practices that directly depend on the cycles and processes involving decomposers in terrestrial, freshwater, coastal, and marine ecosystems (e.g., their role in food production and waste management). ■ Describe the dependence of human practices on the cycles and processes that occur in terrestrial, freshwater, coastal, and marine ecosystems (e.g., the role of decomposers in: food production through soil formation and fertility; waste management through the decay of waste products).	Students learn what humus is and that decomposers form humus as they break down dead organisms. They investigate different soil types and observe the amount of humus in topsoil. They apply their observations to describing why decomposers and humus are essential to agriculture.
6	**The Benefits of Composting** **Preparation Time:** 15 min. **Instructional Time:** 50 min.	■ Provide examples of human practices that directly depend on the cycles and processes involving decomposers in terrestrial, freshwater, coastal, and marine ecosystems (e.g., their role in food production and waste management). ■ Describe the dependence of human practices on the cycles and processes that occur in terrestrial, freshwater, coastal, and marine ecosystems (e.g., the role of decomposers in: food production through soil formation and fertility; waste management through the decay of waste products).	Students revisit the composting lab, observing what has happened since they placed the materials in the bags. They reread ***Wonderful Compost*** and discuss how composting can help California communities manage waste and maintain the health of topsoil used to grow food.

Prerequisite Knowledge	All Materials Needed	Textbook Alignment
Students should be able to: ■ Record simple observations and data. **Students should be able to:** ■ Explain that plants are the source of all foods. ■ Explain that soil is made partly from organic materials and that sandy and clay soils differ in color, texture, capacity to retain water, and ability to support the growth of many kinds of plants. ■ State that plants need water and nutrients to grow.		
Students should be able to: ■ Record observations and data.		

English Language Development

Lessons in the EEI Curriculum are designed to support students' English language development. The strategies in these lessons are based on some of the practices identified in the Reading/Language Arts Framework for California Public Schools (California Department of Education 2007) and ideas adapted from the San Joaquin County Office of Education's Regional Technical Assistance Center.

To establish successful instructional strategies for all students, the teacher should:

- **Use a wide variety of ways to explain a concept or assignment.** When appropriate, the concept or assignment may be depicted in graphic or pictorial form, with manipulatives, or with real objects to accompany oral and written instructions.

- **Provide assistance in the specific and general vocabulary** prior to the each lesson, using reinforcement and additional practice afterward. Instructional resources and instruction should be monitored for ambiguities and language that could be confusing to students, such as idioms.

- **Ask each student frequently to communicate** his or her understanding of the concept or assignment. Students should be asked to verbalize or write down what they know, thereby providing immediate insight into their thinking and level of understanding. In addition, students should be encouraged to confer about each other's understanding of the concept being taught and the classwork or homework assignments, particularly if the students are not fully proficient in English.

- **Check frequently for understanding in a variety of ways.** When a student does not understand, analyze why.

- **Allow students to demonstrate their understanding and abilities** in a variety of ways while reinforcing modes of communication that are used on standardized tests.

- **Use pacing to differentiate instruction according to students' needs.** Reinforce the more difficult concepts for students experiencing difficulty in the language arts by providing additional time and using the visual aids provided. Accelerate the instructional pace for advanced learners if the assessments indicate mastery of the standard.

The California EEI Curriculum includes a variety of research-based English language development practices, such as:

Vocabulary Development

- Teach difficult vocabulary prior to and during the lesson
- Provide reading, speaking, and assessment tasks that reinforce new vocabulary

Reading Comprehension

- Use grade-level readers, articles, and reading assignments to build comprehension in the content area
- Engage students in meaningful interactions about text
- Provide activities that assess student comprehension and build decoding skills

Writing Strategies and Applications

- Provide opportunities for students to organize ideas and information in a written form including concept maps
- Use stories, articles and other written materials to model good writing
- Provide assessment tasks that allow students to apply their grade-level writing skills

Listening and Speaking Strategies and Applications

- Ask questions to ensure comprehension
- Elicit responses from all students, encourage students to give elaborate responses, and give students time to respond to questions
- Incorporate students' responses, ideas, examples, and experiences into the lesson
- Model and teach language patterns needed to understand and participate in the study of the content areas
- Encourage a high level of response accuracy
- Use visual aids, manipulatives, and real objects to support content delivery

The lessons in this unit can be used to support a variety of English language arts skills. This matrix summarizes how each of the lessons can be used to support English language development.

	V Vocabulary	R Reading	W Writing	L Listening	S Speaking
Lesson 1	✓	✓	✓	✓	✓
Lesson 2	✓	✓	✓	✓	✓
Lesson 3	✓	✓		✓	✓
Lesson 4	✓	✓	✓	✓	✓
Lesson 5	✓	✓	✓	✓	✓
Lesson 6	✓	✓	✓	✓	✓

Differentiated Instruction

The 2007 Reading/Language Arts Framework for California Public Schools (California Department of Education 2007) provides guidance for helping students with diverse abilities succeed with California's English–Language Arts Content Standards. The instructional units developed for California's Education and the Environment Initiative provide ample opportunities for teachers to differentiate instruction to meet these needs.

It is important to take into account the State Board of Education's and Department of Education's guidance on differentiated instruction while implementing this instructional unit. Page 263 of the 2007 Framework summarizes this guidance as follows:

The diversity of California's students presents unique opportunities and significant challenges for instruction. Students come to school with a wide variety of skills, abilities, and interests as well as varying proficiency in English and other languages. The wider the variation of the student population in each classroom, the more complex becomes the teacher's role in organizing high-quality curriculum and instruction in the language arts and ensuring that each student has access according to the student's current level of achievement. The ultimate goal of language arts programs in California is to ensure access to high-quality curriculum and instruction for all students in order to meet or exceed the state's English–language arts content standards. To reach that goal, teachers need assistance in assessing and using the results of that assessment for planning programs, differentiating curriculum and instruction, using grouping strategies effectively, and implementing other strategies for meeting the needs of students with reading difficulties, students with disabilities, advanced learners, English learners, and students with combinations of special instructional needs.

Procedures that may be useful in planning for universal access are to:

- *Assess each student's understanding at the start of instruction and continue to do so frequently as instruction advances, using the results of assessment for program placement and planning.*
- *Diagnose the nature and severity of the student's difficulty and modify curriculum and instruction accordingly when students have trouble with the language arts.*
- *Engage in careful organization of resources and instruction and planning to adapt to individual needs. A variety of good teaching strategies that can be used according to the situation should be prepared.*
- *Differentiate when necessary as to depth, complexity, novelty, or pacing and focus on the language arts standards and the key concepts within the standards that students must master to move on to the next grade level.*
- *Employ flexible grouping strategies according to the students' needs and achievement and the instructional tasks presented.*
- *Enlist help from others, such as reading specialists, special education specialists, parents, aides, other teachers, community members, administrators, counselors, and diagnosticians when necessary and explore technology or other instructional devices or instructional materials, such as braille text, as a way to respond to students' individual needs.*

Additional information about best practices in differentiated instruction are detailed in Chapter 7 of the Framework.

Traditional Unit Assessment

Description

Life and Death with Decomposers (Traditional Unit Assessment Master) tests student understanding of decomposers' roles in ecosystems and human dependence on decomposers and the process of decomposition. Questions 1, 2, 3, 5, and 6 demonstrate that students can define "decomposer" and provide examples of decomposers. Questions 3, 5, and 6 demonstrate students' comprehension of roles decomposers play in ecosystems. Questions 7, 8, 9, 11, and 12 assess whether students can provide examples of human practices dependent on decomposers. Questions 12 assess student understanding of how human practices depend on decomposers.

Advanced Preparation

Gather and prepare Assessment Masters.

Suggested Scoring

Use the Answer Key provided on pages 22–24. The total possible score is 19 points.

Preparation Time

10 min.

Assessment Time

45 min.

Life and Death with Decomposers

Traditional Unit Assessment Master | *page 1 of 3*

Name: _____

Multiple Choice: Select the best answer and circle the correct letter. (1 point each)

1. Which three are decomposers?
   a. earthworm, fungi, bacteria
   (b.) bacteria, yeast, mold
   c. scavenger, mold, sow bug

2. Living things that use chemicals to break down matter are called
   (a.) decomposers
   b. scavengers
   c. consumers

3. Decomposers in food chains
   a. are eaten by other consumers
   b. feed on dead plants and animal matter
   (c.) both a and b

4. How do decomposers help humans grow food?
   a. they release nutrients into the soil and make humus.
   b. they clean-up waste.
   (c.) both a and b

5. What would happen if there were no decomposers?
   a. dead animals and plant parts would still decompose.
   b. nutrients would not get back into the soil, water, and air.
   (c.) both a and b

Answer Key and Sample Answers

Name: _____

Read each question and write a complete answer. (2 points each)

6. What are three ways that decomposers help forests and other ecosystems?
They are food for other things in food chains. They help break down matter and keep dead things from covering Earth. They release nutrients inside dead things back into the ecosystem.

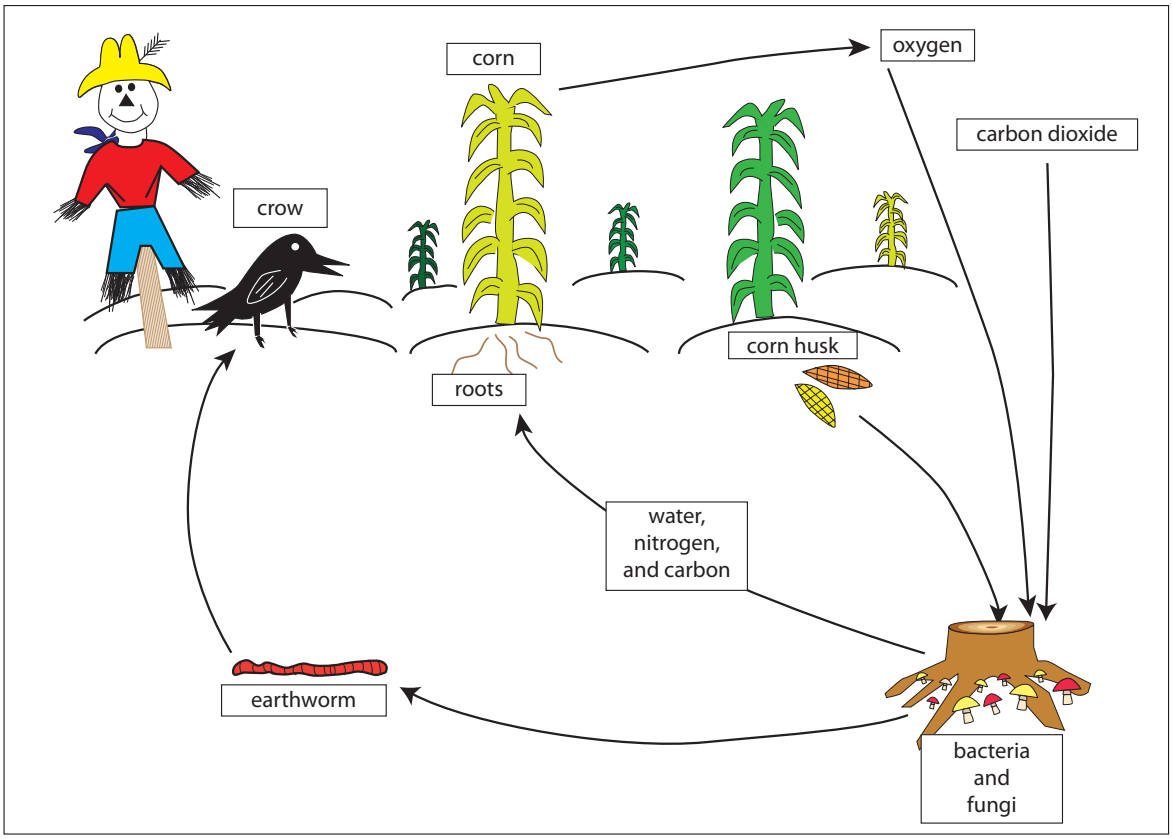
7. Why does agriculture need decomposers?
Decomposers make the topsoil better for growing crops by releasing nutrients from dead things into the soil. Decomposers make humus, which helps soil hold in water for plants to use.

8. How does our wastewater management system use decomposers?
Decomposers break down the waste that comes out of our houses. They break it down more at the treatment plant and in the rivers, lakes, and ocean where the wastewater goes.

9. How do our communities use decomposers to manage our garbage?
Humans put things like apple cores in a compost bin. Decomposers break down this garbage and turn it into compost. If garbage is composted, then there is less garbage going into the landfill.

Name: _____

Look at the diagram and then answer the questions. (2 points each)



10. Name two decomposers in the diagram.
Bacteria and fungi

11. How are these decomposers connected to other things in this diagram?
The decomposers are food for the worm. They break down the dead corn husk and release nutrients back into the air and soil for plants to use.

12. How do humans depend on what is happening in this diagram?
Growing food depends on decomposers to create humus and release nutrients. The plants could not grow without those. Without decomposers, the food chains would stop, too.

Alternative Unit Assessment

Description

This alternative unit assessment can be used in conjunction with, or in place of, the traditional assessment. In this task, each student creates a poster that shows decomposers and decomposition in an ecosystem of the student's choice. On the poster, students must name the decomposers, describe their role in food chains and the nutrient cycle, and describe why they are essential to natural systems and human practices.

Advanced Preparation

Gather and prepare Materials Needed.
Gather and prepare Alternative Unit Assessment Masters.
Gather and prepare Visual Aids:

- Gather from previous lessons:
  - **Large Decomposition Diagram** from Lesson 3. Make sure it is hanging in a visible place.

Materials Needed

- Colored pencils and markers
- Poster paper (white): one per student (four-foot pieces of white butcher paper may be substituted)
- Rulers

Alternative Unit Assessment Masters:

- **Decomposition Poster Instructions**
  One per student

Suggested Scoring

The rubric on page 27 describes elements that should be included in the students' posters as well as expectations for student performance. The highest possible score is 16 points on the rubric.

Preparation Time

30 min.

Assessment Time

50 min. of in-class time, plus homework time to be determined by teacher

Safety Notes

None

Procedures

Step 1

Remind students that they have seen and have made several diagrams that show decomposition in ecosystems. Point out the **Decomposition Diagram** (see Advanced Preparation) to students as one example.

Tell students that they are going to create a decomposition diagram of their own, showing how decomposition is important to all ecosystems.

Step 2

Distribute the **Decomposition Poster Instructions** (Alternative Unit Assessment Master). Read the directions aloud with students and clarify the task by answering any questions they have. Point out the rubric to students so that they know how their posters will be scored. Instruct students to add the due date in the space at the bottom of the instructions page.

Step 3

Give students the rest of the class period to gather materials and information on the ecosystem of their choice or to begin their posters using the materials available.

Step 4

Tell students how much out-of-class time they have to complete the assignment. On the board, write the due date for students' posters to be complete.

Scoring Tool for Alternative Assessment

Decomposition Poster Rubric

Element	4 points	3 points	2 points	1 point
Parts of the Ecosystem	The diagram shows five or more organisms and parts of their habitats.	The diagram shows three or more organisms and parts of their habitats.	The diagram shows one or two organisms and parts of their habitats.	The diagram shows only the organisms. It does not include the non-living parts of their habitats.
Decomposers in the Food Chain	All organisms drawn are named and identified with labels that indicate their place in the food chain.	Many organisms are named and identified with labels that indicate their place in the food chain.	Most organisms are named and identified with labels that indicate their place in the food chain.	Fewer than half of the organisms are named and identified with labels that indicate their place in the food chain.
Decomposers in the Nutrient Cycle	Arrows are drawn and labeled showing where nutrients are released by all decomposers back into the ecosystem.	Many arrows are drawn and labeled showing where nutrients are released by decomposers back into the ecosystem.	Some arrows are drawn and labeled showing where nutrients are released by decomposers back into the ecosystem.	No arrows are drawn or labeled showing where nutrients are released by decomposers back into the ecosystem.
Human Practices That Rely on Decomposers	Poster identifies and describes more than two ways humans depend on the decomposers in the ecosystem.	Poster identifies and describes two ways humans depend on the decomposers in the ecosystem.	Poster identifies one way humans depend on the decomposers in the ecosystem.	Poster does not identify any ways humans depend on the decomposers in the ecosystem.

Decomposition Poster Instructions

Alternative Unit Assessment Master

Make a poster that shows the roles of decomposers and decomposition. First, choose an ecosystem. Then think about how you will show the following:

- **The decomposers in the ecosystem.** What do they look like? How big are they? Where are they found? What do they do?
- **How decomposers are part of the food chain.** What do decomposers eat? Who eats them?
- **What the ecosystem gets from decomposers.** What happens when decomposers do their jobs really well? What does the ecosystem get?
- **Why the decomposers are important to humans.** What do humans depend on from this ecosystem? How do the decomposers help?

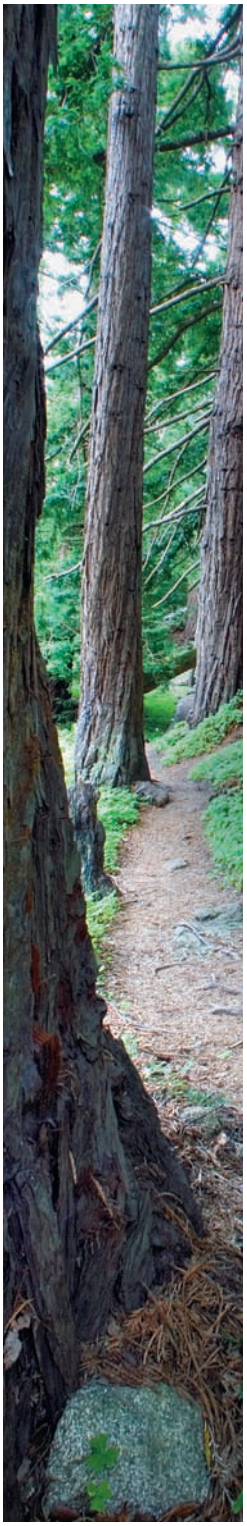
Make sure you put your **name** and a **title** on your poster.

Here is how your poster will be scored:

Your Poster Shows	4 points	3 points	2 points	1 point
Parts of the Ecosystem	The diagram shows five or more organisms and parts of their habitats.	The diagram shows three or more organisms and parts of their habitats.	The diagram shows one or two organisms and parts of their habitats.	The diagram shows only the organisms. It does not include the non-living parts of their habitats.
Decomposers in the Food Chain	All organisms drawn are named and identified with labels that indicate their place in the food chain.	Many organisms are named and identified with labels that indicate their place in the food chain.	Most organisms are named and identified with labels that indicate their place in the food chain.	Fewer than half of the organisms are named and identified with labels that indicate their place in the food chain.
Decomposers in the Nutrient Cycle	Arrows are drawn and labeled showing where nutrients are released by all decomposers back into the ecosystem.	Many arrows are drawn and labeled showing where nutrients are released by decomposers back into the ecosystem.	Some arrows are drawn and labeled showing where nutrients are released by decomposers back into the ecosystem.	No arrows are drawn or labeled showing where nutrients are released by decomposers back into the ecosystem.
Human Practices That Rely on Decomposers	Poster identifies and describes more than two ways humans depend on the decomposers in the ecosystem.	Poster identifies and describes two ways humans depend on the decomposers in the ecosystem.	Poster identifies one way humans depend on the decomposers in the ecosystem.	Poster does not identify any ways humans depend on the decomposers in the ecosystem.

My Decomposition Poster is due on: _____ .

Extensions & Unit Resources



Extensions

Conduct additional decomposition demonstrations, placing organic and inorganic items in separate containers of soil. Add air holes and measured amounts of water to some containers and have students track how long it takes each item to decompose.

Start a worm bin in the classroom (vermicomposting). Have students feed the worms and track decomposition. After three months, have students harvest the compost and use it to pot a plant. Ask students to compare the growth and health of the plant potted in compost versus a plant potted without compost.

Arrange for a field trip to a local community garden that uses composting or to a municipal compost facility. Invite a guest speaker involved in waste management or agriculture to discuss how their work relies on decomposers. Enlist students to help start a compost program at your school.

Arrange for a field trip to a local landfill. When you return to the classroom, have students list the items that they saw that could have been composted, re-used, or recycled.

Resources for Students

Anderson, Margaret. 1991. *Food Chains: The Unending Cycle.* Berkeley Heights, NJ: Enslow Publishers, Inc.

Discovery Education. The Dirt on Soil.
http://school.discoveryeducation.com/schooladventures/soil/field_guide.html

Emory, Jerry. 1996. *Dirty, Rotten, Dead?* Orlando, FL: Harcourt Brace & Company.

United States Environmental Protection Agency. Exploring Estuaries.
http://www.epa.gov/nep/kids

References for Teachers

Brown, Lauren. 1985. *The Audubon Society Nature Guides: Grasslands.* New York: Alfred A. Knopf, Inc.

The Editors of Salem Press, ed. 2004. *Ecology Basics.* Pasadena, CA: Salem Press, Inc.

Environmental Literacy Council. Soil Microbiology. **http://www.enviroliteracy.org/article.php/710.html**

Martin, Deborah L., and Grace Gershuny, ed. 1992. *The Rodale Book of Composting.* Emmaus, PA: Rodale Press, Inc.

Natural Resources Conservation Service. Soil Biology. United States Department of Agriculture. **http://soils.usda.gov/sqi/concepts/soil_biology/biology.html**

Instructional Support

Agencies, institutions, and organizations throughout California have identified themselves as providing programs and materials that support this unit. Links to these resources are available at **http://www.calepa.ca.gov/Education/EEI/instructional_support.html.**